Proposed Resource Management Plan and
Final Environmental Impact Statement

Bighorn Basin Resource Management Plan Revision Project

Appendix C

Monitoring and Evaluation

TABLE OF CONTENTS

LIST OF TABLES

This page intentionally left blank.

APPENDIX C

MONITORING AND EVALUATION

1.0 INTRODUCTION

This appendix provides an overview of the Bighorn Basin Monitoring and Evaluation protocol. Conditions may change over the life of the land use plan and these changes may require different management actions to protect resources and minimize resource conflicts. To address the changing conditions and provide management flexibility that incorporates best management practices (BMP), the Bureau of Land Management (BLM) reviews effectiveness of management actions, assesses the current resource conditions and, if needed, alters management actions.

Due to staffing and funding levels, monitoring will be prioritized consistent with the goals and objectives of the Resource Management Plan (RMP) in cooperation with local, state, and other federal agencies. A system should be established to regularly collect, coordinate and distribute monitoring data collected by other federal and state agencies. Changes to monitoring may result from developing technologies or a better understanding of information.

The monitoring framework for greater sage-grouse is provided in Appendix Y.

2.0 DATA COLLECTION

In cooperation with local, state and other federal agencies, the BLM will collect, analyze, and report monitoring data that allows for the determination of cause and effect, conditions, trends and predictive modeling of land use authorizations. Monitoring methods are implemented to collect data that establish current conditions and reveal any change in the indicators. Monitoring techniques consider when, where, and frequency. The data collected through monitoring provide a variety of information applicable to one or more resource uses. To increase effectiveness, efficiency and eliminate duplication, monitoring methods should be designed to address as many uses as possible. The BLM will collaborate with cooperating agencies and permittees to assist in or perform this data collection.

3.0 DATA ANALYSIS

Data will be analyzed to determine the change that has occurred as a result of management actions. Data analysis will be conducted on a predetermined schedule that considers the data collection frequency for detecting change. Data will also be recorded and organized to facilitate analysis to be used in assessing management actions. Analyzed data will be assessed to determine whether the resource conditions are meeting the planned goals; whether a change has occurred, and if so, identify the cause; and what appropriate action should be taken to achieve the desired outcome if the objective is not being met. New technology and management methods will be reviewed to determine their applicability in modifying or replacing current management actions. The BLM will collaborate with cooperating agencies to assist in or perform this data analysis.

4.0 DECISION

When the assessment shows that the goals are still valid but the outcome is not being achieved, the cause of non-achievement will be documented and a change or modification in management actions would be warranted to address the causal factors. The assessment will develop recommendations to be considered by management for continuation, modification, or replacement of current management actions. Because adoption of a new management action may require changes in the monitoring plan, the assessment will also evaluate the effectiveness of the monitoring and data collection methods and recommend continued use, modification, or elimination of those methods.

5.0 ESTABLISHMENT OF MONITORING PROTOCOLS

Establishing monitoring protocols will follow BLM program specific policy and, where appropriate, the general seven step principles outlined in the Regional Framework for Water-Resources Monitoring Related to Energy Exploration and Development. Those steps are:

1. Specify monitoring goals and objectives.
2. Characterize anthropogenic stressors that may affect receptors and parameters of interest.
3. Develop regional questions and conceptual models to describe the process and pathways anthropogenic stressors may affect receptors.
4. Suggest indicators to measure the effects of anthropogenic stressors, and define existing information availability and needs.
5. Estimate the sensitivity of the indicators to detect change, to guide final indicator choice, and monitoring design.
6. Describe a process by which management can identify thresholds of change requiring a management response as indicated by causal factors.
7. Identify clear connections between the overall monitoring program and management decision process.

6.0 RESOURCE MONITORING TABLE

The resource monitoring table (Table C-1) identifies the indicator that will be monitored to detect change in resource conditions, the method or technique of monitoring, the locations for monitoring, the unit of measurement for monitoring, the frequency for monitoring, and the action triggers that indicate the effectiveness of the management action. Footnotes in Table C-1 indicate where monitoring is generally conducted by stakeholders or cooperating agencies.

Table C-1. Resource Monitoring Table

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Air Quality[1]	M-1	Air quality.	Ambient air sampling and air quality modeling.	Established Monitoring Stations.	Parts per million.	Hourly to 24-hour samples in accordance with standards.	Samples exceeding National Ambient Air Quality Standards.
	M-2	Gaseous and particulate critical air pollutants.	Emission inventory.	Established Monitoring Stations.	Pounds per hour and tons per year.	Annually.	Samples exceeding Ambient Air Quality Standards or levels of concern.
Cultural[2]	M-3	National Register eligible sites.	Site inspection.	Area wide.	Disturbance.	Annually.	Disturbance as a result of land uses or vandalism, fire, and severe weather events such as flooding and erosion.
Fire	M-4	Fire fuels.	Site inspection.	Wildland-urban interface and industrial interface areas.	Acres.	Annually.	Presence of fire fuels that present a risk to communities and industrial sites.
	M-5	Vegetation condition.	Ecological site condition and trend studies.	Vegetation types where there is a history of fire in the ecosystem.	Representative sample.	Annually.	Vegetation growth trend is moving away from desired conditions for the vegetation type.
	M-6	Resource and property damage.	Fire behavior.	Individual fire.	Fire temperature, flame length, burn rate, and acres burned.	While the fire is burning.	Acres burned and fire intensity that exceed prescription.
Forestry	M-7	Forest Health.	Ecological site condition and trend.	Forested lands.	Representative sample area.	Every 3 to 5 years.	Disease, insect infestation, or encroachment of undesirable plant species threatens forest health.
	M-8	Timber stands.	Timber stand examination.	Commercial forested areas.	Board feet, age class, and damages.	Every 10 to 20 years.	Basal area growth does not meet timber type standards.
Lands and Realty	M-9	Realty authorization compliance.	Site compliance inspection.	Area wide.	Number of site inspections.	Annually.	Non-compliance or non-use.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Livestock Grazing	M-10	Vegetation condition	BLM approved monitoring methods; monitoring plans are included in Allotment Management Plans.	All areas being grazed.	Representative sample of grazed area.	Every 5 to 10 years On a priority basis monitor allotments before livestock turnout.	Conditions are not meeting goals and objectives for vegetation due specifically to livestock grazing management. Inconsistent with Guidelines for Livestock Grazing Management, and Wyoming Rangeland Monitoring Guide, and similar guidance updated over time. Not meeting or moving towards Wyoming Standards for Healthy Rangelands.
	M-11	Forage utilization	Utilization study plot or site visit; monitoring plans are included in Allotment Management Plans.	Priority allotments or as needed.	Representative sample of grazed area.	On a priority basis, monitor during and after the area has been grazed.	Utilization consistently exceeds prescribed levels identified in the utilization Appendix W or the vigor of key plant species is declining.
	M-12	Livestock numbers.	Counts and site visits; monitoring plans are included in Allotment Management Plans.	Varies by allotment.	Number of allotments or operators inspected.	Annually or when livestock are moved on or off the allotment.	Livestock numbers exceeding permitted numbers or in areas unauthorized.
Minerals	M-13	Surface disturbance.	Remote sensing or site inspection.	Mineral development sites.	Acres disturbed.	Bi-annual or more.	Acres disturbed exceeding the range established for the area.
	M-14	Compliance with authorization.	Area inspection.	Area wide.	Compliance.	During operations at least bi-annually.	Non-compliance.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Off-Highway Vehicles	M-15	Off-highway vehicle disturbance; establishment of unauthorized vehicle routes.	Remote sensing or site visit; traffic counter data.	Travel Management Area; site-specific to area of disturbance.	Miles of routes; acres of disturbance.	Prioritize areas and monitor higher priority areas every 1-3 years and lower priority areas every 2-4 years.	Disturbance exceeding the baseline, accelerated soil erosion occurring, and vegetation being removed.
Paleontology	M-16	Significant paleontological resources.	Site inspection.	Site.	Degradation or loss of significant fossil resources.	Annually.	Loss or damage to significant fossil resources as a result of human or natural causes.
Recreation	M-17	General recreation use; realization of desired beneficial outcomes.	Onsite Inspection, visitor use data, surveys; document user conflicts or complaints.	Area wide with emphasis on SRMAs and ERMAs with high visitation; areas not managed as recreation management areas but recognized for recreational use and resources.	Changes to desired recreation setting characteristics; changes in experiences and realized desired beneficial outcomes; changes in types, seasons or levels of use.	Prioritize areas and monitor higher priority areas (SRMAs and ERMAs) every 1-3 years and lower priority areas every 3-5 years.	When visitor surveys or public comments indicate that recreation area management objectives are not met; when desired settings, experiences, and beneficial outcomes are not realized; when change is causing undue or unnecessary degradation of the site or area; when change is causing goal interference and conflicts.
	M-18	Concentrated recreation use.	Inspect developed recreation sites or areas that have facilities.	Recreation site.	Condition of recreation site, facilities, visits and visitor days.	Annually.	When change is causing undue or unnecessary degradation of facilities and use areas; public complaints.
	M-19	Compliance with commercial authorization.	Administrative review, site inspection.	Activity site.	Permit stipulations, resource conditions, and site restoration.	During and after an event; annually for other commercial users.	When non-compliance is determined or degradation of resources is occurring.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Special Designations and Management Areas	M-20	Resource condition.	Site visit or remote sensing.	Special designation and management area.	Amount of degradation or loss of resources; impacts to important and relevant resources.	The BLM will monitor the impacts that Resource Management Plan implementation and other approved projects have on National Trail resources, qualities, values, and associated settings and the primary use or uses, including determining the effectiveness of design features, project stipulations, and mitigation measures on a regular basis as the Resource Management Plan and projects are implemented.	Undue or unnecessary degradation or loss of resources or important and relevant resources as a result of human or natural causes.
Wilderness Study Areas	M-21	Wilderness Characteristics (size, naturalness, outstanding opportunities for primitive and unconfined recreation or solitude, supplemental values).	Site visits; aerial monitoring.	Wilderness Study Areas (141,068 acres).	Miles of linear human intrusions; acres disturbed; impacts to wilderness characteristics identified by onsite visit or public comment.	Annually.	Failure to meet the non-impairment standard or other objectives outlined in Manual 6330.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Travel and Transportation Management	M-22	Roads and trails.[3]	Route management categories and maintenance levels; onsite inspection or remote sensing; traffic counter data.	Area wide.	Miles.	Per Facility Asset Management System Condition Assessment Plans.	Conditions represent a hazard to life and property; route conditions do not meet identified road standards.
	M-23	Seasonal closures.[6]	Aerial and field inspections.	Travel Management Areas with seasonal closures for wildlife.	Acres.	Every 5 years.	Changes in use of seasonal habitat requiring closure.
Vegetation	M-24	Trend.	BLM approved monitoring methods.	Area wide.	Representative sample.	Every 2 to 10 years.	Not meeting or moving towards the goals and objectives for 4000 Biological Resources (BR) Vegetation-Grassland and Shrubland Communities or the Wyoming Standards for Healthy Rangelands.
	M-25	Precipitation.[1]	Weather stations.	Representative sample to detect precipitation patterns.	Inches of precipitation.	Monthly and annually.	N/A.
	M-26	Climate.[1]	Weather stations.	Representative sample to detect patterns.	Degrees.	Monthly and annually.	N/A.
	M-27	Noxious weed and invasive plant trends.[4]	Remote sensing or site visit.	Priority areas.	Acres of established weeds and potential habitat areas.	Annually.	Spreading or establishment of invasive species in new areas.
	M-28	Special Status Species.	Site inspection.	Special Status Species' habitats.	Population and trend.	Annually.	A declining trend in populations.
	M-29	Wetland/riparian condition.	Proper Functioning Condition.	Priority wetlands/ riparian areas.	Stream miles and acres along with rating.	Every 1 to 3 years.	Not achieving Proper Functioning Condition or not exhibiting and upward trend.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Visual Resource Management	M-30	Project conformance with VRM Class Objectives.	Remote sensing or site visit; Visual Resource Contrast Rating from Key Observation Points; Visual simulations.	Class I, II, and sensitive III and IV areas.	Measure the degree of contrasting elements against the surrounding natural elements of the landscape (color, form, line, etc.) before and after implementation of an action.	Visual Contrast Ratings will be prepared for projects in visually sensitive areas; comparison of pre and post implementation data will evaluate the sufficiency of project design features in meeting VRM Class Objectives.	Intrusion that exceeds thresholds for meeting VRM Class Objectives.
Water Quality, Watershed and Soils Management	M-31	Surface water quality.[5]	Water sampling.	All surface water.	Milligrams per liter and tons per day.	On a priority basis.	Water quality does not meet state standards.
	M-32	Groundwater quality.[5]	Groundwater sampling.	Established monitoring stations.	Representative sample of water quality.	Annually.	Water quality does not meet state standards and water is migrating from one aquifer to another.
	M-33	Channel geometry.	Riparian cross sections.	Priority streams.	Change in stream channel (width, depth, side channel modification, and bank sloughing).	Every 1 to 3 years.	Conditions are moving away from Proper Functioning Condition.
	M-34	Soil erosion uplands.	Visual observation and surveyed erosion pins.	Area wide where land use activities are occurring.	Soil loss in tons per acre.	Visual examination while land use activity is active and annual site surveys.	When soil loss is accelerated beyond natural levels.
	M-35	Soil erosion on stream banks and floodplains.	Visual observation and surveyed erosion pins.	Area wide where land use activities are occurring.	Area affected in square feet or acres.	Visual examination while land use activity is active and annual site surveys.	Water table is shrinking beyond average precipitation fluctuations.
	M-36	Soil compaction.	Penetrometer or visual inspection.	Area affected by land use activities.	Pounds per square inch.	1 to 2 times annually.	Compaction restricts water infiltration and plant growth.
	M-37	Soil compaction, porosity, permeability, and depth to water.	Monitoring wells (peizometers).	Riparian areas.	Depth to water table.	Every 2 to 3 years.	Accelerated stream bank soil loss.

Table C-1. Resource Monitoring Table (Continued)

Resource	Record Number	Indicator	Method or Technique	Location	Unit of Measure	Frequency	Action Triggers
Wildlife and Fisheries[6]	M-38	Big game seasonal habitat.	Aerial and field inspections.	Crucial wildlife habitat areas.	Numbers during occupancy periods.	Annually.	A change in numbers beyond the normal fluctuations.
	M-39	Special Status Species occupancy and productivity.	Aerial and field inspections.	Habitat areas and established buffer zones.	Numbers during occupancy periods.	Annually.	A decline in numbers beyond the normal fluctuations.
	M-40	Threatened and endangered species occupancy and productivity.	Aerial and field inspections.	Habitat areas and established buffer zones.	Numbers during occupancy periods.	Annually.	A decline in numbers beyond the normal fluctuations.
	M-41	Macroinvertebrate indicator species.	Collecting macroinvertebrate species.	Perennial streams.	Species and condition of macroinvertebrates.	Every 2 to 10 years.	No presence of macroinvertebrates that represent good quality water in the stream.
	M-42	Neo-tropical bird habitat.	Site visit.	Area wide.	Numbers during occupancy period.	Every 2 to 3 years.	Declining trend in habitat occupancy.
	M-43	Raptors.	Site visit.	Area wide.	Nest occupancy rate.	Every 2 to 5 years.	Declining trend in nest site occupancy.
Waterway corridors eligible for inclusion into the National Wild and Scenic River System	M-44	Waterway-specific identified ORV.	Site visits, monitoring, and project proposals.	Eligible waterway corridors.	Miles of linear human intrusions; acres disturbed, impacts to corridor specific ORVs as observed by onsite visit, public comment, or project proposals.	Annually, or when site specific issue arises.	Impacts to corridor specific identified ORVs.

[1]Wyoming Department of Environmental Quality, Air Quality Division is responsible for data collection.
[2]The State Historic Preservation Officer is responsible for data collection.
[3]The County with jurisdiction is responsible for data collection.
[4]The Weed and Pest District and the Animal and Plant Health Inspection Service are responsible for data collection.
[5]Wyoming Department of Environmental Quality, Water Division is responsible for data collection.
[6]Wyoming Game and Fish Department is responsible for data collection.

BLM	Bureau of Land Management
ERMA	Extensive Recreation Management Area
N/A	Not Applicable
ORV	Outstandingly Remarkable Value
SRMA	Special Recreation Management Area
VRM	Visual Resource Management

This page intentionally left blank.